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## Concatenated JPRS Reports, 1990

Document 2 of 8

Page 1

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## FULL TEXT OF ARTICLE:

1. [Interview with Maj. Gen. Avn. Aleksey Arkhipovich Leonov, USSR Pilot-Cosmonaut, twice Hero of the Soviet Union: 'The Flight That Didn't Take Place: Maj. Gen. Avn. A. Leonov, USSR Pilot-Cosmonaut and Twice Hero of the Soviet Union, Talks About the Soviet Lunar Program and Current Problems of the Space Program'; the remarks of interviewer Maj. I. Kuznetsov appear in bold]
2. [Text] Aleksey Arkhipovich, the readers of our journal are interested in the 'blank spaces' in the history of the Soviet space program. One of them is our manned lunar program, in which you had the occasion to be a participant. Please share your recollections with us.
3. The Soviet manned lunar program called for two phases: first, a flight around the moon and, second, the landing of a man on the moon. The technical director of the program was Hero of Socialist Labor Vasily Pavlovich Mishin.
4. The first phase, in the mid-1960s--which is when the specialists at the Center actually became involved in the project--was seen as a reality: the Proton launch vehicle had already flown, and the Soyuz vehicle, which had received the designation L-1 in its lunar modification, was taking shape in metal. The second phase, however, was problematical. Still, we believed that it would come off. Sergey Pavlovich Korolev, even before the decision was made to implement the lunar program, had told us of the powerful N-1 booster and the L-3 vehicle, whose development his team was working on. At the time, we thought that the lunar program was designed to span many years. Plans

UNCLASSIFIED

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2/20/00

42

UNCLASSIFIED

## Concatenated JPRS Reports, 1990

Document 2 of 8

Page 2

for the creation of lunar settlements and for flights to the planets of the solar system were being debated. There was all of that; but reality demonstrated that our dreams were getting far ahead of workable events.

5. The booster that was to be used to effect the program of circumlunar flight had been built and had proved itself admirably. However, the first launch of Zond--that's what the unmanned version of the L-1 was called--was unsuccessful. Why? In order to attain escape velocity, a boost module (the D module) had been installed on the Proton, but the command switching was mixed up, and instead of an acceleration we got a deceleration. The vehicle had to be destroyed. This was the first danger signal. The next launch went well, but then there was another malfunction in the booster. After working for several seconds, it dropped a short distance from the launch site. It turned out that a rubber plug had gotten into the manifold just ahead of the turbopump assembly. Becoming stuck in a duct in the pump, it cut off the fuel supply. After that, major malfunctions resulting in aborted flights occurred every other flight.

6. In 1968, it became clear that we wouldn't accomplish the task before the Americans did. One reason was the lack of proper financing and the improper allocation of funds.

7. You said that the main efforts were devoted to implementation of the L-1 program? How were the cosmonauts trained for that?

8. In all, nearly 20 people were training for the lunar program. The first crews--Leonov and Makarov, Bykovskiy and Rukavishnikov--were formed from among them. The entire group, believing that the goals that were set were achievable, worked diligently, for each one thought that, if the circumlunar flight were successful, he would automatically move on to the next phase with the L-3. Therefore, the training looked toward the future. We mastered many simulators, including a dynamic simulator that was built from a helicopter, and went through the test-pilot course at the Flight Research Institute. Realizing that the most difficult task would be the landing on the Moon, we learned how to quickly pick out an area and set down the craft with limited fuel reserves and how to instantly estimate vertical velocity.

9. Upon returning from the Moon, the landing approach was supposed to be from the direction of Antarctica. In order to learn the constellations in the vicinity of the Southern Cross well, we even flew to Somalia. For independent navigation, the vehicle was outfitted with an astrotracker and sextant, and the cosmonauts devoted much time to the study of those instruments. In the final analysis, everyone learned to work with a complete understanding of

UNCLASSIFIED

UNCLASSIFIED

## Concatenated JPRS Reports, 1990

Document 2 of 8

Page 3

the dynamics of circumlunar flight.

10. To perfect the landing on Earth from escape velocity, the specialists developed a clearcut, detailed procedure with two immersions. We had to learn how to use the astrotracker and sextant to select the angle of entry after the final correction. And the proper angle depends on the magnitude and direction of the retrothrust impulse. If the angle is too large, the vehicle may "dig into" the atmosphere; if it's too small, the vehicle can "overshoot" the atmosphere. The best version is an entry with a "skip": you enter the atmosphere, exit it, and, after losing high velocity, enter again, all the while keeping in mind which angle of attack the vehicle must maintain to reach the designated touchdown point. The "Manual Impulse Entry" instrument flashed the number of impulses after covering the first segment. We also used it to figure out the distance to the designated touchdown point. The distance was then converted into an angle of attack. All those operations were perfected in the dynamic "Volchok" simulator. In the end, we learned to make a "landing" with a precision of within a kilometer. After passing examinations on the design of the vehicle and the flight program, the cosmonauts were ready for circumlunar flight.

11. The flight would be difficult, even in terms of just the living arrangements, because, unlike Soyuz, the L-1 did not have an orbital module, and two people would have to spend a week in the descent module. We had high hopes as we watched the last unmanned flight. But, when the nose shield was jettisoned, a command was also sent to jettison the parachute system. The ship hit the ground and was flattened. Curiously, some of the film that it was bringing back was intact. As a result, we were the first to get beautiful, extremely clear photographs of Earth from the Moon.

12. In December 1968, the Americans performed a circumlunar flight with Apollo 8, and our leaders were shaken: "Do we need to do it now? General Designer Mishin nonetheless managed to perform one more test flight of the unmanned version. And again a failure. Problems with the flight configuration led to depressurization of the craft. I should add that all three launches of the N-1 booster rocket in the flight-design testing were unsuccessful. Soberly sizing up the situation, the government shut down the program for landing a man on the Moon.

13. Aleksey Arkhipovich, was our plan any different from that of the Americans?

14. Our lunar lander was similar to the American lander, and the flight plans, as envisioned even by Kondratyuk, were in no way different from theirs. The craft had to attain a circumlunar

UNCLASSIFIED

UNCLASSIFIED

## Concatenated JPRS Reports, 1990

Document 2 of 8

Page 4

reference orbit, and a capsule would separate from it and make a soft landing on the Moon. It's true, though, that unlike the American plan, ours involved landing just one person. But the operations on the Moon and the return to Earth were exactly the same.

15. I remember that the Soviet Union was conducting investigations of the Moon with unmanned satellites at the same time. They provided us with interesting information that was even more complete than what the Americans had at the time. But there was one other difference.

16. The accident aboard Apollo 13, involving an explosion of a fuel element, demonstrated the very flexible thinking of the American leaders. Having been honest in giving out all the details, they were able to rally the entire nation at the time. Literally all of America was watching that mission, living through it, thinking about how to rescue the crew and making suggestions. But we always hushed up our emergency situations, trying to show the superiority of Soviet engineering. In actual fact, we had many more emergencies than did the Americans. But that wasn't told to the people. Therefore, many got the impression that the development of outer space was a rather simple affair, and that the upkeep for the cosmonauts was costing the government a lot and was economically unjustified.

17. How did you follow the execution of the Apollo program by the Americans?

18. The entire world, except for the Soviet Union and China, watched the first step of man onto the Moon. But none of the Soviet people, except for at most a hundred people watching the news reports in one of the organizations, saw the launch of the craft, its landing on the Moon, or the activities of the crew. History has rightly judged our ideologues, Ponomarev and Suslov, and the course with which they guided the country. But the Americans have no false morality. In 1965, they gratefully accepted all our information on the walk in space and coordinated their own program with it. If at first they had planned to have an astronaut just stick his arm out of the craft, now they duplicated my space walk and even used a hand-held space gun that enabled the astronaut control his body somewhat in space. Returning to the American lunar program, let me say that there are no "blank spots" in it for me. Moreover, I have the flights of Apollo 10 through 17 saved on video cassette.

19. And have you seen any extraterrestrials in your films? The UFO watchers claim that the first men on the Moon saw them, and that extraterrestrials were watching the astronauts. Is this true?

20. Those who are prone to every kind of sensationalism have taken a phrase in the astronauts' conversation out of context and are

UNCLASSIFIED

UNCLASSIFIED

## Concatenated JPRS Reports, 1990

Document 2 of 8

Page 5

building their fantasies on it. After the landing on the Moon, clear communications were set up with the flight control center in Houston. A picture was sent to the Moon and back. Neal Armstrong, exiting from the ship, stepped onto the surface very carefully, and then he grew bolder, and his steps became more confident, and he began to jump. I've seen those frames. James Aldrin, turning to him, said, "Look out, they're watching us." "They" in the sense of "Earth." Then he advised Armstrong not to violate the instructions and to be more careful. And in fact, after that, Neal Armstrong began to walk with normal steps. I have told the UFO watchers repeatedly, "Why are you speculating about this? It's not at all what you think."

21. We have created the reusable Buran, it has gone through the first tests, and now some--for example, Academician Sagdeyev--say that we don't need it. What is your opinion?

22. We have the Mir program. If we really want to collect dividends, we have to be able to bring back to Earth the materials involved in the research that is carried out. The Soyuz craft can return a small volume of cargo that weighs a maximum of 100-120 kg. We are planning to return tons. Only Buran can do that. In light of that, I can't agree with Sagdeyev when he says that there's nothing for Buran to do in orbit. We need it as a component part of the transport system of the Mir program. Sagdeyev is not right here.

23. On top of that, he was silent before now, and now he is raising objections. It would be more ethical on his part to be giving an accounting for his own project: why did the Phobos vehicles, which he launched and in which large sums were invested, fail before reaching their target?

24. This, it seems, would be a good place to touch on the matter of improving the profitability of space?

25. The space program, being the embodiment of the leading scientific and engineering thinking, is indeed capable of a much larger economic return. The Americans, after spending \$25 billion on the lunar program, subsequently made a profit twice that figure through the introduction of new technologies and developments. The situation is somewhat different with us. But whose fault is that? The space program's?

26. As far back as the '30s, Academician Kapitsa posed this question to the economic council of the Sovnarkom: What incentives for adoption of new inventions are built into the Soviet system? And he answered the question himself: "I see none." The situation has not changed since that time. What projects have the economists not justified to please the politicians--"depeasantization," the

UNCLASSIFIED

UNCLASSIFIED

## Concatenated JPRS Reports, 1990

Document 2 of 8

Page 6

'elimination of unpromising villages,' the 'redirecting of the courses of the northern rivers,' and other pitifully memorable projects. And to this day, there is no economic mechanism to encourage enterprises to adopt new products or technologies that, in abundance, lie unclaimed in the space sector, for example. That is where the talk of the poor profitability of space comes from. But that's not the space program's fault--it's the space program's misfortune.

27. I remember how we were asked to monitor farm lands from space. In a matter of days, we produced a mountain of information; but it differed by 25-30 percent from the amount issued by Goskomstat [State Committee for Statistics]. And they refused our services. We explained that many of the fields are either smaller than indicated by the data of the Agroprom, or are not being used, and therefore were not included in the reckoning. The results of mismanagement are also very visible from space: pastures trampled down, rivers and ponds ruined, the air in cities polluted. We can talk about all the outrages committed on Soviet soil, for example, by the Ministry of Land Reclamation and Water Resources. There's a lot of talk today about the Aral Sea and Lake Balkhash. And yet, the cosmonauts were the first to sound the alarm, 15 years ago. I myself went to Pelsha, the chairman of the Party Control Committee of the CPSU Central Committee, and told him what was happening on the Baykal-Amur Railroad and at the Aral Sea. Although certain decisions were made with regard to the Baykal-Amur Railroad, nothing has been done for the Aral.

28. It seems that no one has any use for our information. I personally feel that it is primarily the economists who should be reproached for that. And here the press should place the emphasis where it belongs. Good communications are needed, in both directions, and then there will be an economic impact.

29. And the last question, often asked by the readers of our journal: Do you think those of us living today will witness the realization of a Soviet lunar program?

30. No such program is envisaged before the year 2000. After that, we shall see.

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